

## Using Task Evaluation and Reflection Instrument for Student Self-Assessment (TERISSA) To Improve Educational Assessment and Feedback

Iouri Belski

RMIT, Melbourne, Australia

iouri.belski@rmit.edu.au

***Abstract:** Over 500 students enrolled in Electronic Engineering courses at RMIT since 2001 have learnt to use the Task Evaluation and Reflection Instrument for Student Self-Assessment (TERISSA). TERISSA engages students in self-assessment of their subject knowledge whilst they resolve problems. It requires a student to conduct two task evaluations: when the task is first presented and after the task has been resolved and to reflect on each of these evaluations and on the reasons for the discrepancy between the evaluations. This engages students in regular reflection, provides them with valuable feedback on their learning and gradually enhances their thinking and problem solving skills. TERISSA can also provide teaching staff with feedback on student understanding of the course material.*

### Importance of Educational Feedback

The importance of educational assessment and feedback has been widely discussed among scholars for many years. The recent DEST Report on student responses to the Course Experience Questionnaire (CEQ) has put assessment and feedback at the top of the list for the three main areas of student concern at Australian universities (Scott, 2005).

The Report demonstrates the importance of assessment and feedback both for the students:

*“Promptness with which assignments are returned, use of staged deadlines, quality of the feedback received including the extent to which markers comment on what was done well, explicitly identify key areas for improvement and say how improvements could have been achieved..”*

and for the teaching staff:

*“...actively interested in receiving student feedback on how the course is going, and promptly make necessary adjustments and improvements to its delivery in light of this feedback;”*

The following are some of the Report (Scott, 2005) findings specifically related to feedback:

*... ‘feedback’ includes quality of comments, quantity of comments, and timeliness of comments.*

*Feedback is identified as being about assignments, questions, practical work, industry work, projects, theses, studio practice, exams—both mid-semester and final.*

*Feedback is also focused on how a student is doing overall.*

*Students observed that ... they did not know how to improve for the next assessment task.*

*Students wanted feedback on overall progress as well as specific feedback on assessment tasks.*

The data from various student surveys (internal RMIT Course Evaluation Survey CES, and CEQ) identify Engineering as one of the lowest scoring disciplines providing students with helpful feedback

on their learning. The quote “*Many students complained of poor quality feedback, low quantity feedback (only a mark, maybe with one or two words) and the previously mentioned time problems*”, provided in the Report (Scott, 2005) is likely to come from a student enrolled in an engineering degree.

There are a number of reasons why engineering programs and courses score the lowest on educational feedback, which include the following:

- The engineering curriculum is heavily modularised, so assessment evaluates student proficiency in one narrow area of study at a time. Over a 12 to 13 week semester engineering students are usually involved in learning through four to six different modules (e.g. Electronics 101: basic circuit Laws, circuit Theorems, DC analysis, AC analysis, frequency behaviour and the Bode plots.). Normally, self directed work and assessments relate to these separate modules and student knowledge is evaluated on the basis of their proficiency in one specific module separately (e.g. an ability to sketch the Bode plots).
- As a rule, assessment is based on resolving problems with known correct answers and on an accepted practice in mathematics-related subjects; that is, to grade work by deducting marks for the errors made without much written feedback on the reasons for the errors. Engineering students are normally expected to resolve problems in order to become proficient. Computational problems are given to evaluate student comprehension of the theoretical aspects of the subject. Computer-based simulations (like PSpice or MATLAB in electrical engineering) are designed to support the theoretical underpinning of the subject and to create a bridge between practical laboratory and project work. Normally, all assessments have only one correct answer or provide a range of acceptable answers (practical work). Therefore, if a student makes a mistake whilst resolving the problem, an engineering academic normally deducts an appropriate number of marks for mistakes made and does not comment on the mark reduction and/or the errors explicitly. Staff members expect that because the assessment is on a very narrow area of knowledge, the deduction is self-explanatory.
- Although various assignments are given to students regularly (usually two to four times during the semester), assignments do not occur every week. Moreover, it is usual to expect a week or so delay in marking these assignments. This leaves students completely unaware of their learning progress for up to four weeks at a time. Furthermore, as a result of this, teaching staff do not have reliable feedback on class performance in the subject for extended periods of time.
- Modules studied in an engineering course are normally interrelated. Usually, the next module requires thorough knowledge of the previous one in order for a student to be able to resolve problems in the new module. Engineering educators expect that as soon as a particular module has been 'covered', it has been properly understood by the students, so students are fully capable of applying the principles learnt in a subsequent topic. When the material from any particular study week is not comprehended by a student properly, it is likely that a student will have even bigger gaps in his or her knowledge when studying the new material in the following weeks.
- Most students do not reflect on and/or analyse the tasks they are given systematically. This may relate to the ‘engineering mindset’, which shows some negativity towards reflection journals and situation analysis. This may lead to the inability to learn from mistakes efficiently. This also hinders students’ ability to self-learn and to think clearly and effectively.

## TERISSA and Engineering Problem Solving

The Task Evaluation and Reflection Instrument for Student Self-Assessment (TERISSA) has been developed by Belski (Belski, 2002) and is based on the deployment of both situational analysis and reflection, which have been found to be vitally important in developing thinking and problem solving skills (Polya, 1988; Altshuller, 1984; Hammond, J.S., Keeney, R.L. and Raiffa, H., 1999). Reflection and situation analysis are also essential in enhancing students’ learning (Marshall, Rowland, 1998; Biggs, 2003).

TERISSA engages students in self-assessment of their subject knowledge while they resolve problems. It requires a student to conduct two task evaluations: when the task is first presented and after the task has been resolved, and to reflect on each of these evaluations and on the reasons for the discrepancy between the evaluations. This engages students in regular reflection, provides them with valuable feedback on their learning and gradually enhances their thinking and problem solving skills. TERISSA can be used every time a student is involved in subject activities (both individual and group). This ensures that students receive feedback on their learning frequently and in a timely manner. In the past five years TERISSA has been successfully used in tutorial classes, home and class individual and group exercises, various home assignments and practical laboratory work.

Engineers are involved in problem solving more often than other professions. This problem solving focus seriously impacts upon the engineering curriculum and teaching methods. This is why engineering students are extensively involved in solving problems which are closely related to the topics they study. This problem solving focus makes TERISSA very efficient in engineering education. Once engineering students are involved in daily problem solving, they can self-assess their knowledge using TERISSA regularly, and are likely to achieve sustainable improvements in their thinking and problem solving skills.

### The Roots of TERISSA

The predecessor of TERISSA – task evaluation – was used for the first time in 1999 (Belski, 2002). While conducting tutorial classes in electronic engineering, the author noticed an alarming pattern of student behaviour. Every time that students' were presented with a problem to resolve, most of them immediately grabbed their calculators and started pressing buttons. They did not allocate even a short period of time to analyse the problem and were basically wasting their time with the calculators. In order to change such student behaviour, the author developed a simple tool for situation analysis and reflection. Every time problem solving was involved, students were asked to evaluate the complexity of a problem twice: before it was resolved and after the answer was found. The following scale of complexity was proposed: 1 – very simple; 2 – simple; 3 – so-so; 4 – difficult; 5 – very difficult. Students were also asked to individually reflect on these evaluations in writing.

The results of the first run were very encouraging. Not only were the students able to enhance their thinking and problem solving skills, they were also able to get valuable feedback on their learning. Moreover, this valuable feedback had been gained without the direct involvement of a lecturer!

Although TERISSA was introduced to students as a tool for individual use, students from tutorial classes undertaking Electronic Engineering 3 in 1999 were also asked to share their opinions on a problem's complexity level by raising their hand when the appropriate difficulty level was named by a lecturer. All the opinions were counted and the averages for the initial and the final evaluations were calculated. Figure 1 presents an example of a similar TERISSA application in semester 1, 2007.

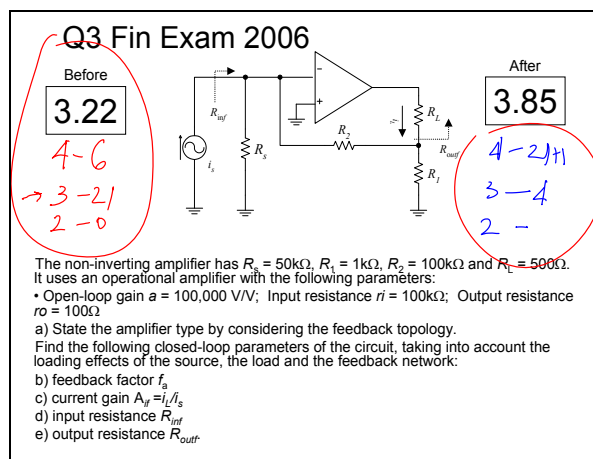


Figure 1. Deploying TERISSA during tutorial, semester 1, 2007

Figure 1 presents both individual student opinions on the complexity of the problem (shown in figure 1 as written by hand on a tablet PC) and the class averages (inside the boxes).

While using TERISSA in tutorial classes and analysing student opinions on the complexity of the problems presented, the author was able to receive weekly feedback on student knowledge and their progression in the course. This was entirely unexpected and has helped to re-develop and fine tune the course and also to adjust exercises/assignments to the needs of students.

The current version of TERISSA, although still based on task evaluation, contains a set of questions which guide students in estimating the level of difficulty of a task, and in reflecting on the reasons for their evaluation. This involves students' in conducting a simple situation analysis and then questioning their assumptions based on their knowledge of the subject. When estimating task complexity for the first time, a student reflects on the reasons for why she/he has given the particular 'complexity score' and asks themselves why the score is not one level lower. Final reflection requires a student to think of the rationale for the final 'complexity score', the grounds for the discrepancy between the first and the final evaluations, and about the learning needs of the student. Usually, TERISSA takes five to ten minutes to complete. It can be learnt quickly and, being a student self-assessment tool, does not need teaching staff intervention.

Since 2001, students have been asked to use TERISSA every time they are presented with any assessment task or homework exercise, and when resolving problems in tutorial classes, or conducting laboratory and simulation experiments. TERISSA has been used both individually and in group work. When used in class, it also helps students to evaluate where their subject knowledge stands in comparison to the other students in the class.

### **Effectiveness of TERISSA: Student Surveys 2004 – 2007**

Since 2004, students enrolled in Electronic Engineering subjects coordinated by the author have been asked to evaluate the efficiency of TERISSA in providing them with feedback on their learning and on enhancing their thinking and problem solving skills. The data collected over the past four years clearly shows that TERISSA is very helpful for most students. It has also been found that TERISSA provides valuable feedback to the teaching staff on students' progress and the areas of weakness or gaps in student knowledge.

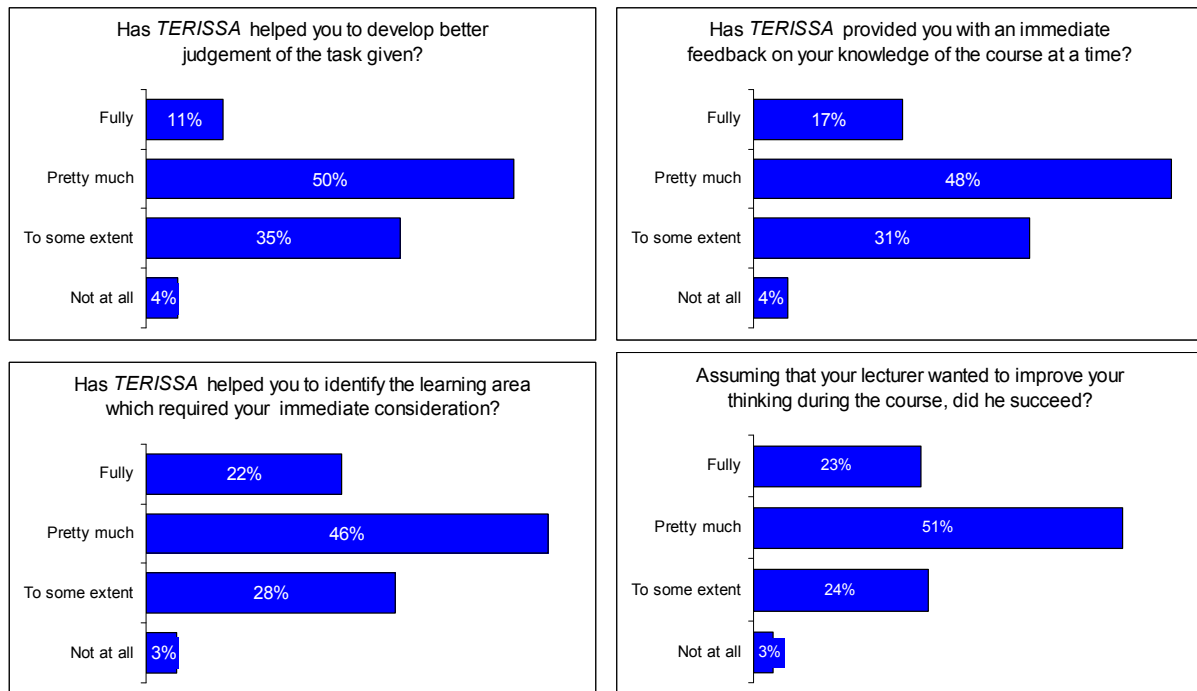
Figure 2 presents some results from student surveys on TERISSA, conducted in Electronic Engineering 3 classes in 2004 – 2007 (total number of students who participated: 229).

Figure 2 shows student answers to the following four questions:

- Has TERISSA helped you to develop better judgement of the task given?
- Has TERISSA provided you with immediate feedback on your knowledge of the course at any given time?
- Has TERISSA helped you to identify the learning area which required your immediate consideration?
- Assuming that your lecturer wanted to improve your thinking during the course, did he/she succeed?

Student opinions presented in Figure 2 are encouraging and identify the efficiency of TERISSA. Only 3 to 4 percent of all the students surveyed (about 9 students from 229) had not found TERISSA useful in their learning. Over 96% (220+ of 229) of surveyed students believed that TERISSA had helped them in their learning. Over 61% (137+ of 229) of them were certain that TERISSA helped them significantly in their learning.

*Belski, Using Task Evaluation and Reflection Instrument for Student Self-Assessment (TERISSA) To Improve Educational Assessment and Feedback*



**Figure 1. Student Opinions of TERISSA, 2004 - 2007**

The following are some individual student opinions on the *task evaluation*. They are presented in three groups – relating to valuable educational feedback on their learning, concerned with improvement of thinking and problem solving skills, and the feedback on student learning progress in comparison to other students studying the same subject:

**A. Valuable feedback on student learning (individual and class work)**

- “Makes me see my weakness”.
- “...forces me to consider whether I really understand the topic...”
- “Forces self-analysis and highlights exactly which aspect/concept I was unsure about.”
- “Basically you find out where you stand regarding the problem...”
- “Made me look at my learning and understanding, and how it can be improved”.
- “From the task evaluation I know where am I at the given topic”.
- “Gives me an indication of my progress”
- “The comparison of the initial evaluation and final evaluation assist in my understanding of whether my knowledge matches to what I actually know”.
- “Forces me to think about what I do not understand on the problem.”

**B. Student thinking and problem solving skills (individual and class work)**

- “It makes you think how you are going to approach the problem.”
- “Makes me think harder about the task before giving up”.
- “Helped me to see that I often consider tasks to be more difficult than they are.”
- “It makes you to really look at the problem at hand”.
- “It helps with motivation of the student. When the student learns that the task’s difficulty is due to internal factors (i.e. students understanding) and that not external (i.e. the question is hard and ‘I can’t do anything about it’)”.
- “How I analyse a problem and how different I perceive a problem before and after I solved it”.
- “Specify what the problem needs to resolve! Then re-evaluate again.”
- “By that we can understand how hard is that question and how much we have to work on it.”
- “The evaluation of a problem makes you think how you are going to approach the problem”.
- “Making you think about the question in parts, to find the exact problem you have with it.”

**C. Student progress in respect to others (TERISSA used during tutorials)**

- “Gave an indication of my progress in comparison to the rest of the class”.
- “A gauge of our learning in relation to others in the class”.
- “To know how others are going in the class”.
- “Gives you an understanding of what other students are at. Helps to identify my weaknesses and strengths”.
- “Able to see where you are at relative to the difficulty of the task.”
- “It was good to see how my thoughts on the complexity of a problem compared to the progress made by other students.”
- “Knowing how I compare to others. Having a reference to compare against exams and tests in the future”.
- “It helps to analyse the task at hand and compare your position to others”.
- “Finding out how I am dealing with the work compared to my class mates. So I know where I am falling behind”.

### TERISSA: Why Does It Work?

Since 2001, TERISSA has been successfully used by students for self-assessment while resolving homework exercises (marked and unmarked), home and class assignments and during team work in tutorial classes. When TERISSA is deployed in class conditions, students perform individual evaluation and reflection and are also expected to indicate their individual opinions about the task’s complexity by raising their hand when the necessary complexity task is identified by a tutor. As has been discussed above and shown in Figure 1, the number of students who voted for a particular ‘complexity score’ is recorded and the average ‘class complexity score’ is calculated. The five levels of ‘complexity score’: 1 (very simple), 2 (simple), 3 (so-so), 4 (difficult), 5 (very difficult) have been retained.

Figure 3 presents the comparison of pre- and post-solution evaluation of task complexity for the problems considered in tutorial classes in Electronic Engineering 3 in semester 1, 2007 (one of the tutorial classes, 38 students).

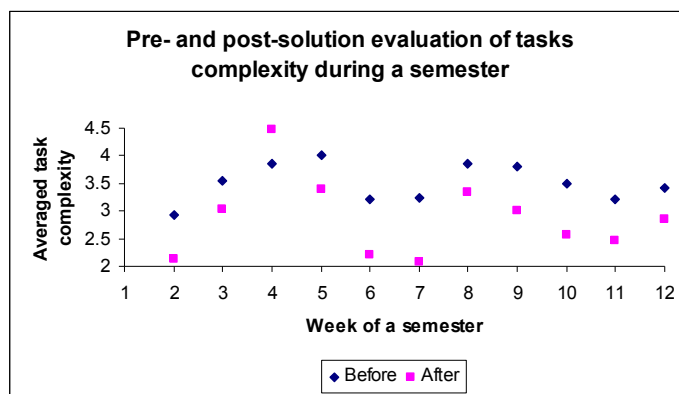


Figure 3. Pre- and post-solution evaluation of task complexity, tutorials 2007

It is clear from Figure 3 that the difference of pre- and post-solution evaluation of an average task’s complexity is significant and is close to one difficulty level (e.g. *difficult* before and *so-so* after, as happened in week 9). Individually students often recorded this difference to be equal and even exceeding two levels (e.g. *difficult* before and *easy* after). Similar average discrepancy has been recorded in two student take-home assignments, which involved both mathematical calculations and a computer simulation (P Spice). Normally, students overestimate the complexity of a task that they face at the beginning. Only rarely (week 4 in Figure 3) did they think that the task they were given looked less difficult before it was resolved.

The discrepancy pictured in Figure 3 is not surprising - it simply shows that students are learning new concepts and material. Nonetheless, the fact that student pre- and post-solution evaluation of task

complexity differs significantly is fundamentally important for TERISSA to be an efficient tool. A student usually does not expect any discrepancy, and TERISSA shows them their inability to judge the degree of difficulty accurately. This provides students with at least one good reason to reflect on why the original ‘complexity score’ differed from the final one. This may result in a change of mental attitude towards self-reflection, which is clearly visible from students’ individual opinions (section A of student feedback above). By using TERISSA regularly, a student learns the importance of reflecting both before and after the task has been resolved, and gets much more feedback on their learning from these reflections.

Moreover, they also learn that devoting a few minutes to situation analysis before engaging in problem solving can save time and effort and help in resolving a problem quickly. This is also well supported by students’ opinions (section B of student feedback above).

It is also clear that when TERISSA is used in class, individual students are able to evaluate their learning progress in comparison to the rest of the class (section C of student feedback above).

### Effectiveness of TERISSA: Subject and Program Comparison

Another indication of the effectiveness of TERISSA in student self-assessment can be derived by comparing the statistical results of student answers to the following CES statement depicted in Figure 4, which were compiled from RMIT Surveys undertaken in semester 1, 2007:

“This course contributes to my confidence in tackling unfamiliar problems”

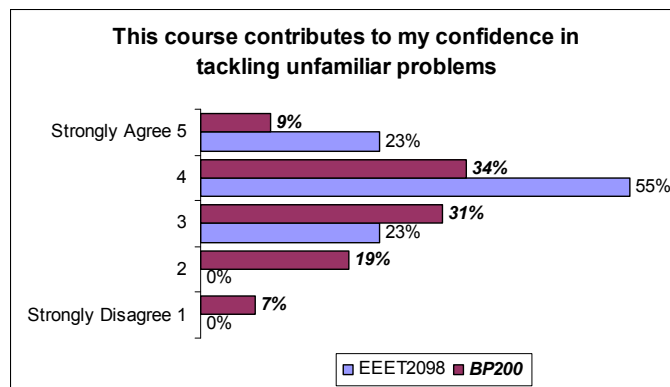


Figure 4. Subject – Program comparison, RMIT CES, semester 1, 2007

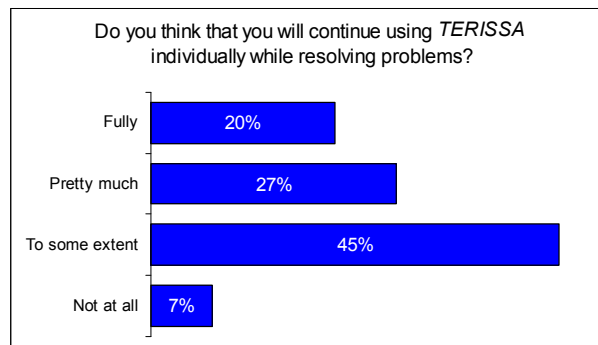
The lighter columns show the survey results for the Electronic Engineering 3 subject (denoted as EEET2098). The darker columns identify the overall results for all the subjects included in the degree program (denoted as BP200). Forty three students responded to the EEET2098 survey, 661 students participated in surveys of subjects in the program.

Student opinions depicted in Figure 4 are much more positive for the subject, than for the program. This supports the fact that by using TERISSA, students are able to enhance their thinking and problem solving.

A similar pattern to the ‘subject to program’ relationship has been discovered for student perceptions of helpful feedback (CES questions: “The teaching staff normally give me helpful feedback”; “The teaching staff in this course motivate me to do my best work”; “The staff put a lot of time into commenting on my work”), as well as on fairness of assessment (CES question: “Assessment tasks in this course require me to demonstrate what I am learning”). The formal assessment used in EEET2098 was basically very similar to the assessment used in all other subjects of the BP200 degree – several class tests, one or two take-home assignments and laboratory work. Assessment tasks were related to the topics studied. However, the tasks in EEET2098 were ‘designed’ for students using TERISSA. Thus, a significant difference in student opinions (presented in Figure 4), as well as differences in subject assessment and feedback are at least partly related to the use of TERISSA in EEET2098.

## Belski, Using Task Evaluation and Reflection Instrument for Student Self-Assessment (TERISSA) To Improve Educational Assessment and Feedback

Students were further asked whether they intended to use TERISSA individually in other courses, in semester 1, 2007. The opinions of 44 students who participated in the survey are presented in Figure 5.



**Figure 5. Student opinions on future usage of TERISSA**

Student opinions presented in Figure 5 clearly show that at least 47% of students were convinced of the usefulness of TERISSA. One semester of using the tool was sufficient to show students the efficiency of TERISSA. Another 45% of students appeared to see some benefit in using the tool but required additional practice to accept TERISSA as a regular application.

### Conclusion and Future Plans

Data collected over the past four years on the application of TERISSA clearly shows that the tool is helpful in student self-learning. TERISSA has provided valuable and frequent feedback to students on their learning and often helped them to identify the area of study which required additional attention. It has also been discovered that using TERISSA has provided teaching staff with a clearer indication of students' prior knowledge, and has permitted staff to monitor student learning better.

In 2007, RMIT supported the use of TERISSA with the LTIF Grant, by providing funds to evaluate its usage in various courses from different programs. In semester 2 of 2007, six RMIT lecturers will involve over 500 RMIT students from different degrees in applying this tool. TERISSA will be used in tutorials, assignments, projects, tutorial and home tests. It is expected that as a result of this trial, TERISSA will be further refined and recommendations to lecturers and students on its application will be further updated.

### References

- Altshuller, G.S., (1984), *Creativity As An Exact Science*, Gordon & Breach Science Publishing House, NY.
- Biggs, J. (2003), *Teaching for Quality Learning at University*, SRHE and Open University Press, USA.
- Marshall, L., Rowland, F. (1998), *Learning Independently*, Pearson Education Australia.
- Belski, I. (2002) Seven Steps to Systems Thinking, *Proceedings of the 13<sup>th</sup> Annual Conference and Convention Australian Association of Engineering Educators*, Canberra, Australia, Sept. 2002, pp 33-39.
- Hammond, J.S., Keeney, R.L. and Raiffa, H., (1999), *Smart Choices: A Practical Guide To Making Better Decisions*, Harvard Business School Press, Boston, MA.
- Polya G., (1988), *How To Solve It: A New Aspect Of Mathematical Method*, Princeton University press, NJ.
- Scott, G. (2005), *Accessing the Student Voice: Using CEQuery to identify what retains students and promotes engagement in productive learning in Australian higher education*, DEST Report  
[http://www.dest.gov.au/sectors/higher\\_education/publications\\_resources/profiles/access\\_student\\_voice.htm](http://www.dest.gov.au/sectors/higher_education/publications_resources/profiles/access_student_voice.htm)

### Copyright statement

Copyright © 2007 I. Belski: The authors assign to AaeE and educational non-profit institutions a non-exclusive licence to use this document for personal use and in courses of instruction provided that the article is used in full and this copyright statement is reproduced. The authors also grant a non-exclusive licence to AaeE to publish this document in full on the World Wide Web (prime sites and mirrors) on CD-ROM and in printed form within the AaeE 2007 conference proceedings. Any other usage is prohibited without the express permission of the authors.